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THE COUNTRY CODE AND NUMBER OF YOUR PRIORITY APPLICATION, TO BE USED FOR FILING ABROAD UNDER THE PARIS CONVENTION, IS ***US60/505,047***

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17414 U.S. PTO 09/22/03

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

INVENTOR(S)

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Raymond G.	Thompson	Birmingham, Alabama

☐ *Additional inventors are being named on the ___ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

EDDY CURRENT INSPECTION OF MATERIALS

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ENCLOSED APPLICATION PARTS (*check all that apply*)

- [X] Specification *Number of Pages* 6
- [X] Drawing(s) *Number of Sheets* 7
- [X] Application Data Sheet. See 37 CFR 1.76
- ☐ CD(s), Number
- ☐ Other (specify)

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

- [X] Applicant claims small entity status. See 37 CFR 1.27.
- [X] A check or money order is enclosed to cover the filing fees
- [X] The Director is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number:
- ☐ Payment by credit card. Form PTO-2038 is attached

DEPOSIT ACCOUNT NO.	FILING FEE AMOUNT ($)
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

[X] No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: ______

Respectfully submitted,

SIGNATURE [signature]

DATE 9/22/2003

TYPED or PRINTED NAME Jeffrey C. Aldridge

REGISTRATION NO. (*if appropriate*) 51,390

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DOCKET NO. ET-005 Prov.

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

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Docket No. ET-005 Prov.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Irving I. Dardik et al.

For : EDDY CURRENT INSPECTION OF MATERIALS

Mail Stop PROVISIONAL PATENT APPLICATION
Commissioner for Patents
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Alexandria, Virginia 22313-1450

EXPRESS MAIL CERTIFICATION

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I hereby certify that this certification and the following papers:

1. Postcard;

2. Provisional Application Cover Sheet (in duplicate);

3. Specification (six (6) pages);

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Claire J. Saint-van Goodman

ET-005 Prov.
Eddy Current Inspection of Materials

Eddy current inspection is described below. This application is to use superwaves as the excitation current and/or voltage signal. Superwaves in any of its manifestations will be used to produce higher intensity and lower signal-to-noise eddy currents as described below. This will result in faster and more accurate inspections. It will also enable inspectors to find smaller defects in difficult to inspect materials and configurations.

Eddy current inspection is used in a variety of industries to find defects and make measurements. One of the primary uses of eddy current testing is for defect detection when the nature of the defect is well understood. In general the technique is used to inspect a relatively small area and the probe design and test parameters must be established with a good understanding of the flaw that is trying to be detected. Since eddy currents tend to concentrate at the surface of a material, they are generally used to detect surface and near surface defects.

In thin materials such as tubing and sheet stock, eddy currents can be used to measure the thickness of the material. This makes eddy current a useful tool for detecting corrosion damage and other damage that causes a thinning of the material. The technique is used to make corrosion thinning measurements on aircraft skins and in the walls of tubing used in assemblies such as heat exchangers. Eddy current testing is also used to measure the thickness of paints and other coatings.

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Eddy currents are also affected by the electrical conductivity and magnetic permeability of materials. Therefore, eddy current measurements can be used to sort materials and to tell if a material has seen high temperatures or been heat treated, which changes the conductivity of some materials.

Eddy current equipment and probes can be purchased in a wide variety of configurations. Eddyscopes and a conductivity tester come packaged in very small and battery operated units for easy portability. Computer based systems are also available that provide easy data manipulation features for the laboratory. Signal processing software has also been developed for trend removal, background subtraction, and noise reduction. Impedance analyzers are also sometimes used to allow improved quantitative eddy-current measurements. Some laboratories have multidimensional scanning capability that are used to produce images of the scan regions. A few portable scanning systems also exist for special applications such as scanning regions of aircraft fuselage.

Eddy current inspection uses an electrical signal to generate magnetic flux in a coil. FIG. 1 shows a simple electric circuit. The inductor is the coil of wire. The electrical generator would produce SuperWave forms of electrical signals.

Typical electrical signal wave forms used today are either sinusoidal or square (FIG. 2). Superwaves would be used in place of these standard waves.

This "superwaves" pulse pattern is in accordance with superwaving activity as set forth in the theory advanced in the Irving I. Dardik article "The Great Law of the Universe" that appeared in the March/April 1994 issue of the "Cycles" Journal. This article is incorporated herein by reference.

As pointed out in the Dardik article, it is generally accepted in science that all things in nature are composed of atoms that move around in perpetual motion, the atoms attracting each other when they are a little distance apart and repelling upon being squeezed into one another. In contradistinction, the Dardik hypothesis is that all things in the universe are composed of waves that wave, this activity being referred to as "superwaving." Superwaving gives rise to and is matter in motion; i.e., both change simultaneously to define matter-space-time.

Thus in nature, changes in the frequency and amplitude of a wave are not independent and different from one another, but are concurrently one and the same, representing two different hierarchical levels simultaneously. Any increase in wave frequency at the same time creates a new wave pattern, for all waves incorporate therein smaller waves and varying frequencies, and one cannot exist without the other.

Every wave necessarily incorporates smaller waves, and is contained by larger waves. Thus each high-amplitude low-frequency major wave is modulated by many higher frequency low-amplitude minor waves. Superwaving is an ongoing process of waves waving within one another.

FIG. 3 (adapted from the illustrations in the Dardik article) schematically illustrates superwaving wave phenomena. FIG. 3 depicts low-frequency major wave 110 modulated, for example, by minor waves 120 and 130. Minor waves 120 and 130 have progressively higher frequencies (compared to major wave 110). Other minor waves of even higher frequency may modulate major wave 110, but are not shown for clarity. This same superwaving wave phenomena is depicted in the time-domain in FIG. 3A.

This new principle of waves waving demonstrates that wave frequency and wave intensity (amplitude squared) are simultaneous and continuous. The two different kinds of energy (i.e., energy carried by the waves that is proportional to their frequency, and energy proportional to their intensity) are also simultaneous and continuous. Energy therefore is waves waving, or "wave/energy." In accordance with the invention, the signal eddy current inspection uses to generate magnetic flux in a coil is derived from superwaving wave activity.

When electrical current is fed through the inductor it produces magnetic flux. The inductor is made into a probe for various applications. Several inductor probes are shown in FIG. 4.

The inductor probes create magnetic flux which penetrates the surface of the materials to be inspected. The magnetic flux creates electrical currents near the surface of the material being inspected as shown in FIG. 5. Using superwaves to create the flux (instead of conventional waves) preferably creates greater turbulence in the probed material, and therefore, increases and intensifies the production of eddy currents. The increased and intensified eddy currents preferably provide more information about the probed material than any of the conventional waves.

The eddy currents penetrate the surface to varying depths depending on the material being inspected and the frequency of the signal in the eddy current electrical circuit. This is shown in FIG. 6.

The eddy currents can be used for a variety of inspection applications as discussed in the introduction and as detailed in the following ASTM inspection standards.

British Standards (BS) and American Standards (ASTM) relating to magnetic flux leakage and eddy current methods of testing are given below. National standards are currently being harmonized across the whole of Europe, and British Standards are no exception. Harmonized standards will eventually be identified by the initials BS EN; for example, BS 5411 has been revised and is now known as BS EN 2360. Harmonization is unlikely to be completed before 2001. The year of updating a British Standard is given in brackets. ASTM standards are published annually and updated when necessary.

British Standards (BS):

BS 3683 (part 5):1965 (1989) - Eddy current flaw detection glossary;

BS 3889 (part 2A): 1986 (1991) - Automatic eddy current testing of wrought steel tubes;

BS 3889 (part 213): 1966 (1987) - Eddy current testing of nonferrous tubes; and

BS 5411 (part 3):1984 - Eddy current methods for measurement of coating thickness of nonconductive coatings on nonmagnetic base material. Withdrawn: now known as BS EN 2360 (1995).

American Society for Testing and Materials (ASTM):

ASTM A 450/A450M - General requirements for carbon, ferritic alloys and austenitic alloy steel tubes;

ASTM B 244 - Method for measurement of thickness of anodic coatings of aluminum and other nonconductive coatings on nonmagnetic base materials with eddy current instruments;

ASTM B 659 - Recommended practice for measurement of thickness of metallic coatings on nonmetallic substrates;

ASTM E 215 - Standardizing equipment for electromagnetic testing of seamless aluminum alloy tube;

ASTM E 243 - Electromagnetic (eddy current) testing of seamless

copper and copper alloy tubes;

ASTM E 309 - Eddy current examination of steel tubular products using magnetic saturation;

ASTM E 376 - Measuring coating thickness by magnetic field or eddy current (electromagnetic) test methods;

ASTM E 426 - Electromagnetic (eddy current) testing of seamless and welded tubular products austenitic stainless steel and similar alloys;

ASTM E 566 - Electromagnetic (eddy current) sorting of ferrous metals;

ASTM E 571 - Electromagnetic (eddy current) examination of nickel and nickel alloy tubular products

ASTM E 690 - In-situ electromagnetic (eddy current) examination of nonmagnetic heat-exchanger tubes;

ASTM E 703 - Electromagnetic (eddy current) sorting of nonferrous metals;

ASTM E 1004 - Electromagnetic (eddy current) measurements of electrical conductivity;

ASTM E 1033 - Electromagnetic (eddy current) examination of type F continuously welded (CW) ferromagnetic pipe and tubing above the Curie temperature;

ASTM E 1316 - Definition of terms relating to electromagnetic testing; and

ASTM G 46 Recommended practice for examination and evaluation of pitting corrosion.

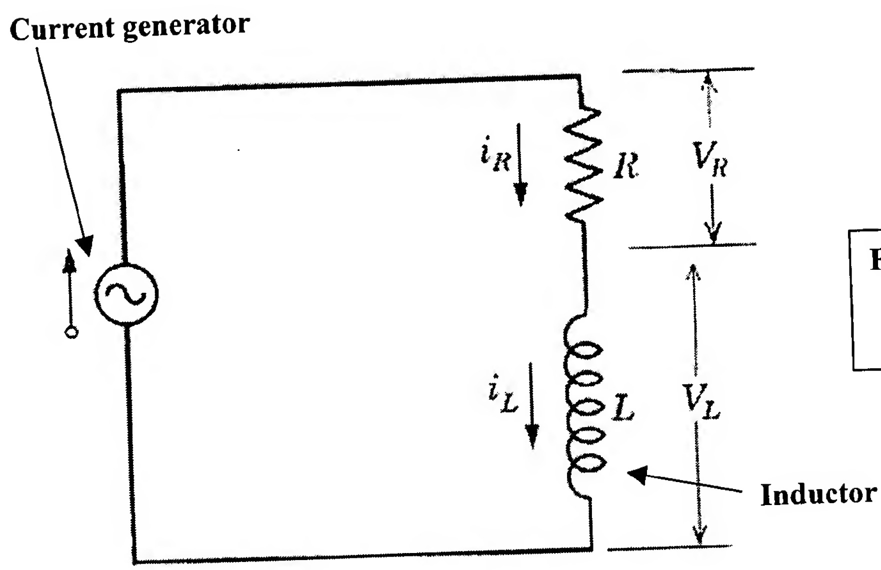


FIG. 1

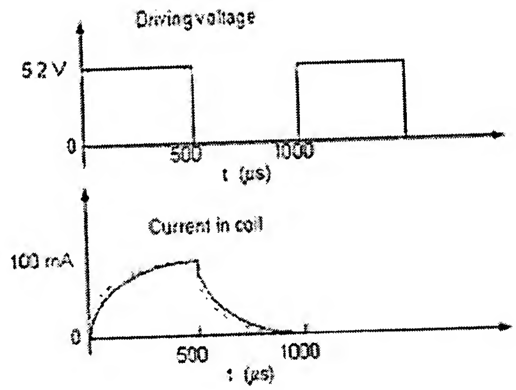


FIG. 2: Square voltage wave.

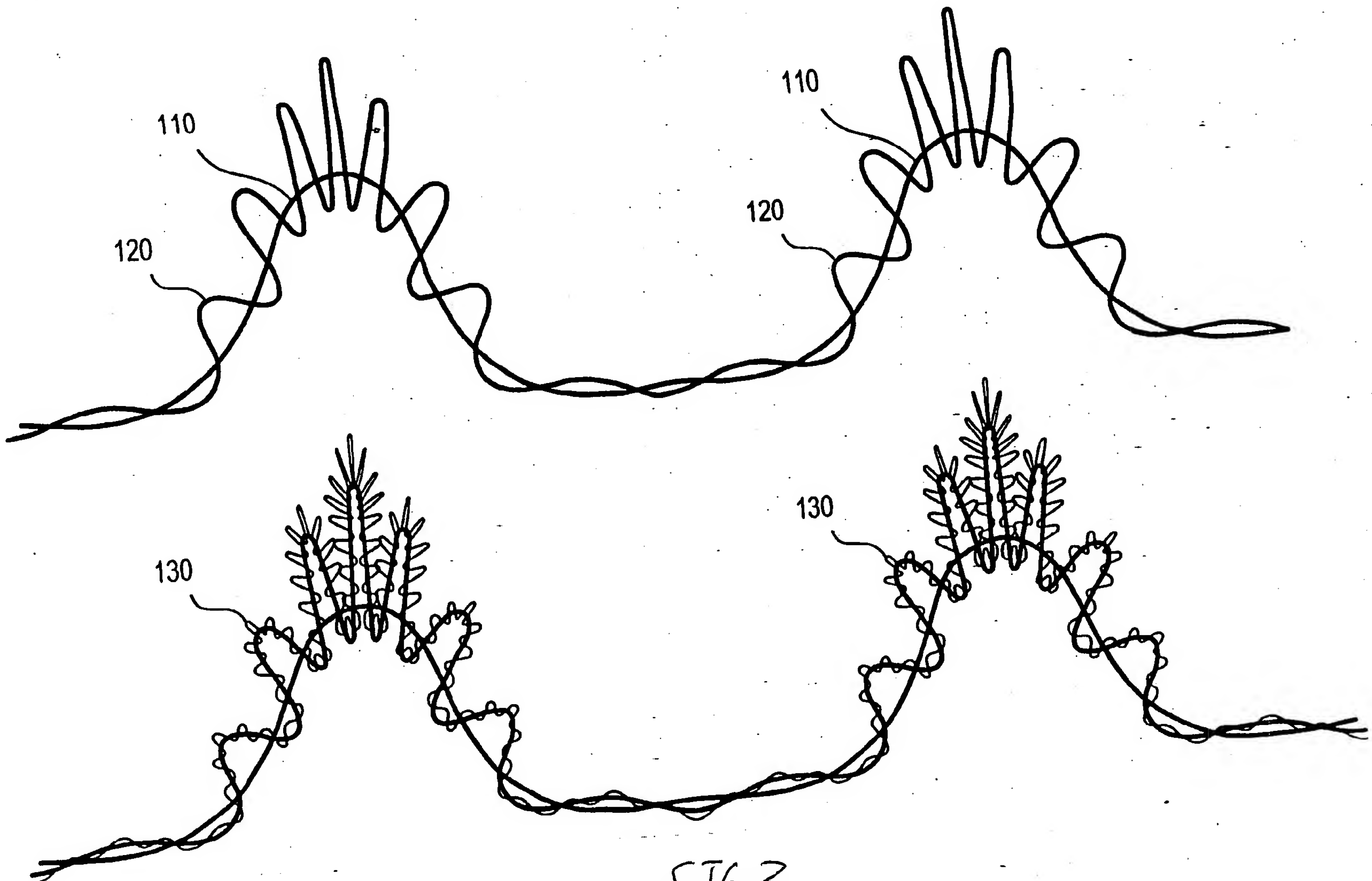


FIG. 3

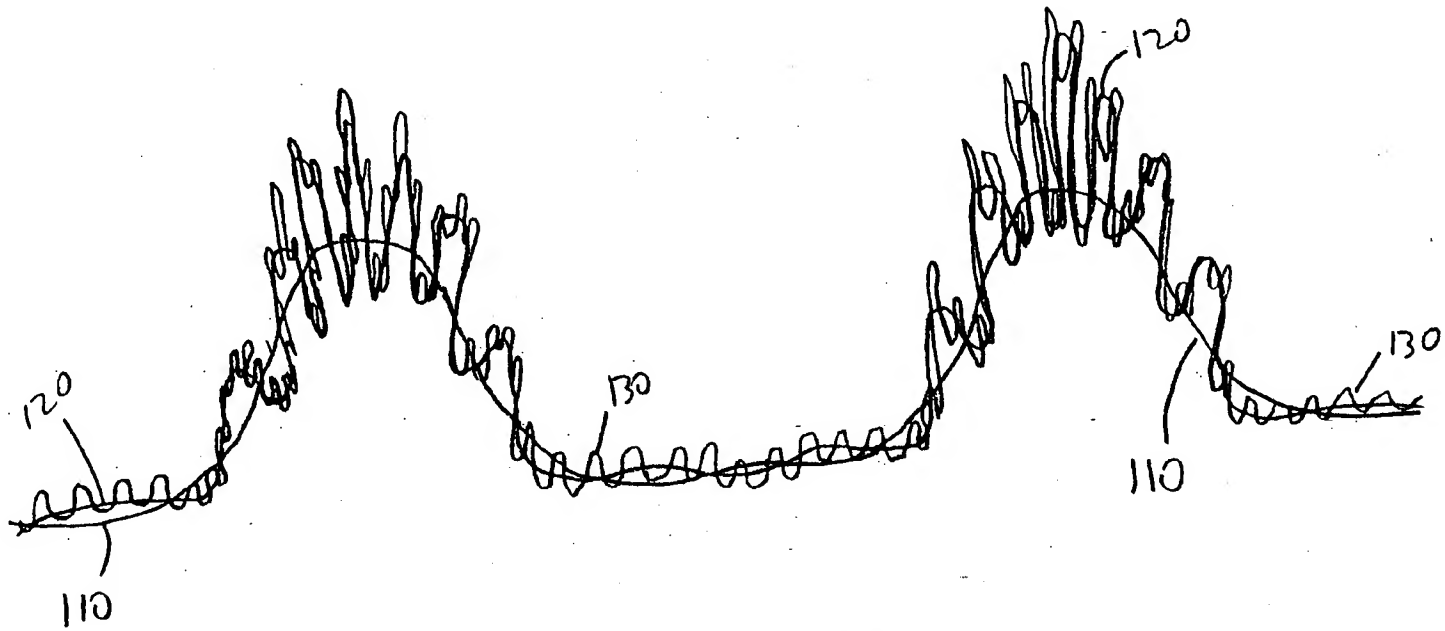


FIG. 3A

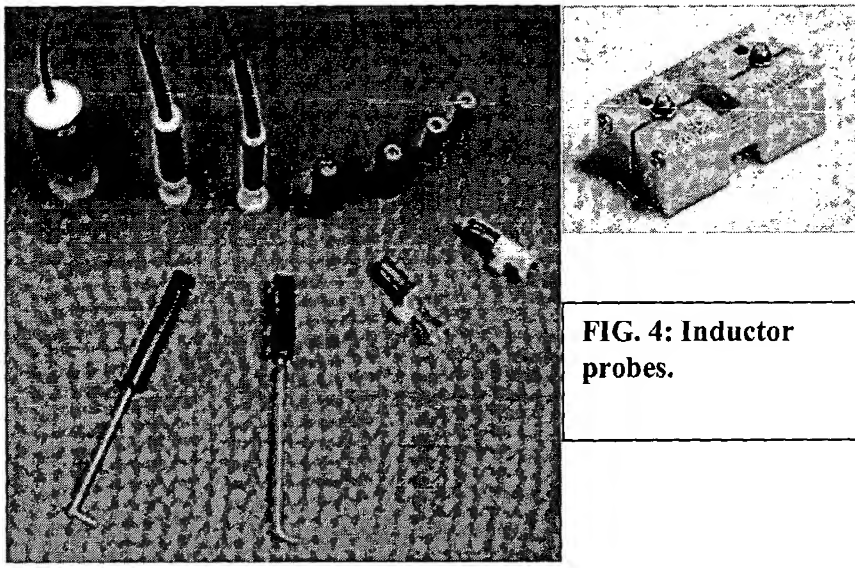


FIG. 4: Inductor probes.

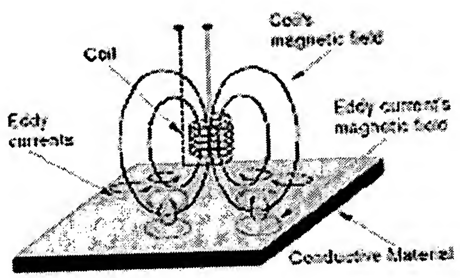
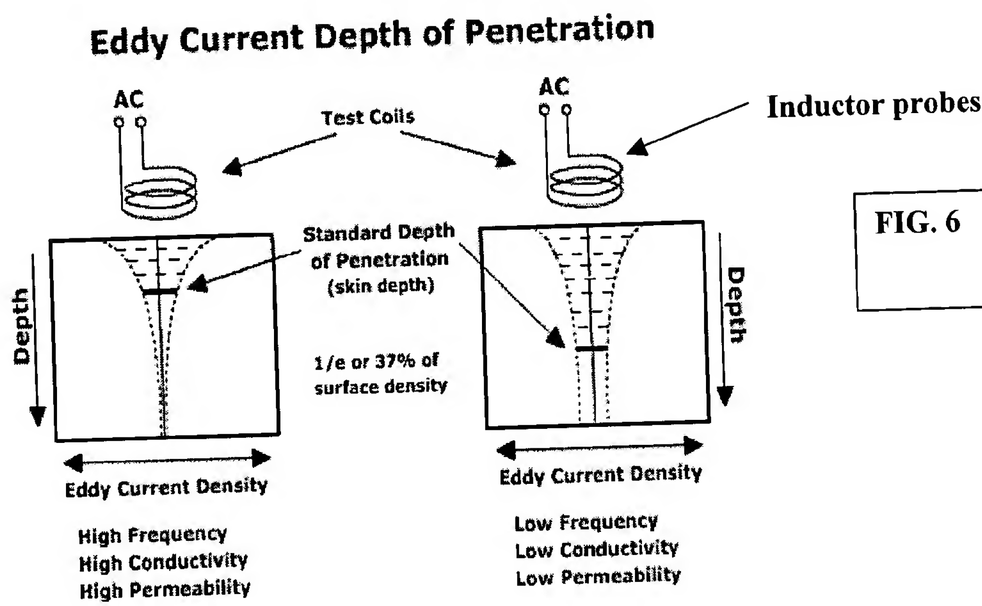


FIG. 5: Eddy currents near surface.



Eddy Current Depth of Penetration
AC
Test Coils
AC
Inductor probes
Standard Depth
of Penetration
(skin depth)
1/e or 37% of
surface density
Depth
Depth
Eddy Current Density
Eddy Current Density
High Frequency
High Conductivity
High Permeability
Low Frequency
Low Conductivity
Low Permeability

FIG. 6

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APPLICATION INFORMATION

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Application Type:: Provisional
Docket Number:: ET-005 Prov.
Secrecy Order in Parent Appl.?:: No

REPRESENTATIVE INFORMATION

Representative Customer Number:: 1473
Registration Number One:: 51390
Registration Number Two:: 44398

Source:: PrintEFS Version 1.0.1